ADDRESSES

DELIVERED ON

LAYING THE CORNER-STONE

OF

AN EDIFICE

FOR THE

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,

October 30, 1872.

PHILADELPHIA:
COLLINS, PRINTER, 705 JAYNE STREET.
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NEW HALL

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The corner-stone of a new building for the Academy of Natural Sciences of Philadelphia was laid, Wednesday, October 30, 1872, at the southeast corner of Race and Nineteenth streets. The digging of the cellar of the north wing was commenced July 9, 1872.

At half-past eleven o'clock A.M. many of the officers and members of the society assembled at the hall, northwest corner of Broad and Sansom streets, and walked together to the site of the new building.

At twelve o'clock, noon, Dr. Ruschenberger, President of the Society and Chairman of the Building Committee, addressed the assembled crowd in substance as follows :—

Ladies and Gentlemen :—

We have assembled to-day to manifest our satisfaction that, through the intelligent liberality of a comparatively few of our fellow citizens, we are enabled to commence the erection, on this spot, of a new building adapted to the purposes of the Academy of Natural Sciences of Philadelphia. The want of a sufficiently capacious edifice has embarrassed, and in some degree retarded, the progress of the institution during many years. The citizens of Philadelphia and of the State of Pennsylvania have a wide-spread interest in the success of this enterprise, although that interest is not universally recognized or admitted.

The completion of the entire edifice, one wing of which we have

commenced to build, and the arrangement in it of the collections now belonging to the institution, will be as palpable evidence of educational progress, in one department of the exact sciences, as can be presented; and it will be so estimated by those who may come here from abroad, in the summer of 1876, to determine our intellectual advancement during the hundred years of our national existence.

The object of the society is to acquire exact knowledge of all created things, within the narrow limits of man's capability to investigate, and to give freely to the whole world the knowledge which may result from its labors. Its constant effort is to remove the veil which conceals from us the facts of the Creation in order that all may perceive and recognize their wonderful wisdom and beauty. Attainment of precise truth is the extremely difficult task assumed by this, and every society formed for the cultivation of the natural sciences. Yet, under an erroneous and wide-spread notion that the pursuit of truth on this line is in some indefinite manner detrimental to society, it has been and is still opposed by very many intelligent people.

Truth is a unity, vastly multiple in constitution, but no one of its parts is inconsistent with another. Every absolutely established truth, be it great or small, must be in perfect accord with all that has been or ever will be ascertained by man. The criterion of truth in natural science is its harmony with all that is absolutely known. Every scientific assumption which is not true, however plausible it may appear on presentation, will prove to be discordant. In God's creation there is no conflict or contradiction of parts. When accurately interpreted the perfect harmony of their relations will be manifest. The book of nature is entirely free from error; it contains no misstatement of any kind. Surely such a book may be studied without perverting the mind from truth or establishing a preference for what is not reality.

Seeking the truths of nature demands an extensive workshop, in which to collect and arrange conveniently for use the numerous implements employed in the work. The implements consist in collections of all those natural objects which have been described properly classified and labelled, ready for study and comparison with those supposed to be new—that is, not previously described—and also an extensive collection of books in which are recorded the results of investigations made by naturalists in all parts of the

world; for he who would add to the stock of knowledge in any department of science needs to be acquainted with what is known already in it, or he may find himself laboring to discover what has been ascertained. A museum and library, chemical apparatus and microscopes, constitute the machinery necessary to facilitate and guide his labors. Such a museum and library and laboratory, in such condition as to be utilized by the naturalists, require large space, and this demand for space increases with the progress of our knowledge.

The Academy now possesses more than 6000 minerals; 700 rocks; 65,000 fossils; 70,000 species of plants; 1000 species of zoöphytes; 2000 species of crustaceans; 500 species of myriapods and arachnidans; 25,000 species of insects; 20,000 species of shell-bearing mollusks; 2000 species of fishes; 800 species of reptiles; 31,000 birds, with the nests of 200, and the eggs of 1500 species; 1000 mammals and nearly 900 skeletons and pieces of osteology. Most of the species are represented by four or five specimens, so that, including the archæological and ethnological cabinets, space is required now for the arrangement of not less than 400,000 objects, besides the library of more than 22,500 volumes.

Besides space enough in our workshop to appropriately arrange this vast number of implements, room is desired for a separate and distinct arrangement of all objects necessary to illustrate the natural history of the State of Pennsylvania, as well as a suitable room in which lectures on the natural sciences may be delivered.

To set up this great museum and library, laboratory and lecture room, we have a plot of ground, measuring little more than an acre, for which we are indebted to the liberality of members of the society and individual citizens. No substantial encouragement has been yet received from the government of this city, nor from that of the State of Pennsylvania.

In this respect, the policy of some of the State Legislatures is more encouraging. Massachusetts has given liberal aid to the Boston Society of Natural History; to the Museum of Comparative Zoology, at Cambridge; and to the Institute of Technology. New York maintains a museum of natural history, at Albany, by annual appropriations, and has given eighteen acres of land, valued at four millions of dollars, and five hundred thousand dollars besides, to establish a natural history museum at Central Park, in the city of New York.

The institutions thus aided are of great value but no one of them as a whole equals ours in scientific importance or intrinsic worth, or is better entitled to public favor.

I mention these facts in no spirit of envy or detraction. We are all gratified to know that the number of laborers in the vast field in which we work is everywhere increasing. The encouragement extended to them by State governments implies that the cultivation of the natural sciences is becoming more and more wisely appreciated, and more widely diffused.

I will detain you no longer.

Rev. E. R. Beadle, D.D., was introduced to the audience and said, substantially, that Philadelphia had been facetiously designated as "a dining station on the road to New York;" but he doubted whether that was all that can be truthfully said about Philadelphia. He referred to the hospitals for the sick, asylums for children, retreats for the aged and indigent, and the neat and comfortable domiciles provided for working people, as well as to the schools, colleges, university, and expressed his belief that, although not yet finished, Philadelphia is doing very well. The building of the Academy of Natural Sciences is one of the works yet to be done. He alluded to the popular ignorance of even the simplest matters which influence the life, happiness, and comfort of humanity, and said that a workshop is wanted in which young people may be taught to recognize the properties and uses of natural objects—to distinguish what is fact from what is not—and be trained to apply such knowledge intelligently for the benefit of themselves and of mankind.

Prof. J. Aitken Meigs, M.D., of the Jefferson Medical College, was next introduced and delivered the following address:—

Three-score years, heavy-laden with the endless series of changes, the thrilling narrative of private joys and sorrows, hopes and fears, the extraordinary record of national triumphs and social defeats, and the wondrous history of the great achievements and miserable failures that go to make up the life-history of two generations of men, have been forever engulfed in the illimitable ocean of the past, since the occurrence of that event the happy development of which you this day celebrate.

In this brief period—comprised within the life-time of some who now hear my voice—the most remarkable historical events have occurred, and many surprising scientific discoveries and important industrial applications of them have been made. Indeed, by means of intellectual inquiry and its handmaid, applied science, the social and industrial condition of the world, during this short interval, has been completely revolutionized.

Look at Philadelphia as it appeared at the commencement of 1812, as it has been pictured, in truth, by a medical worthy of that time. A city whose inhabitants numbered 111,120, or less than one-sixth of its present population, occupying an area not one-half of that over which it now stretches its huge proportions; a city which contained 25,814 dwelling-houses, 6955 public buildings, stores, manufacturing establishments, etc.; 42 churches, 11 insurance offices, 4 banks, 2 hospitals, a university, an Academy of Fine Arts, a museum of natural history, and 2 theatres in which performances were occasionally given; a city in which 51 printing-offices, employing 153 hand-presses, were in operation; a city boasting of 8 daily, 9 weekly, and several semi-weekly newspapers having a combined circulation of about 61,000 copies per week—such, in brief, was the city of Penn sixty years ago.

Neither in this country nor in Great Britain, at that time, had railroads and steamboats been put into operation. Electricity, the modern Puck, had not yet learned the art of "putting a girdle round about the earth in forty minutes." The telegraph had not been invented. Communication between distant points was slow and uncertain. Instead of a few minutes, as is now the case, weeks were required for the transmission of intelligence from Philadelphia to the Gulf of Mexico. Our city was then two months distant by sail from Europe, and six from California, instead of being, as at present, within eight or nine days of the former, and but seven days' ride by rail from the latter. The steam-plow, the reaping-machine, and the screw-ship were not in existence. The printing-press and the spinning-jenny were worked by hand instead of by steam. The photographic art was not known. The old-fashioned tinder-box and brimstone-match had not yet been replaced by the lucifer match, and oil, instead of gas, was an universal means of illumination. In short, a thousand mechanical and chemical influences which are incessantly changing the aspect of our present civilization were then utterly unknown.

Come back with me, in imagination, to the period of time just mentioned. It is the evening of the last day of the week, near the close of January, and the nipping air sweeps eagerly up this broad thoroughfare from the icy river below. Let us cross over and take refuge from the wintry blast in yonder quaint-looking house at the northwest corner of Second and High streets. From the imposing array of many-colored bottles, seen through the dimly-lighted window, and the inevitable sign of the pestle and mortar surmounting the doorway, you gather, at a glance, that it is the shop of a druggist. Let us enter, for this is one of the centres of the literary and scientific gossip of the town. Passing through an atmosphere odorous with the emanations of camphor, rhubarb, and musk, we find ourselves in a little room at the rear, and in the presence of a group of men gathered around a table and engaged in earnest conversation. At the further end of the room stands a young man, who, with animated countenance and impressive gesticulations, appears to be addressing the others upon a subject of some importance. The lineaments of his face bear the stamp of an earnest, ingenuous, and benevolent mind; and now, as he ceases speaking, and his face falls again into its accustomed repose, it assumes an unmistakably reflective character. This is the proprietor of the store—one John Speakman, a native of Bucks county, and a member of the religious society of Friends. That young gentleman sitting at the right of the table is Jacob Gilliams, a dentist by profession, and an ardent lover of the natural sciences. The individual by his side, bending over the table, with his eyes intently fixed upon the speaker, is John Shinn, Jr., a manufacturing chemist from New Jersey. In front of the latter, and upon the opposite side of the table, sits a native of France, Nicholas J. Parmantier, by name, who follows the occupation of a distiller and manufacturer of cordials. That man yonder, apparently older than his comrades, and whose broad and massive brow clearly betokens a mind given to profound thought, is Dr. Gerard Troost, a Hollander of Bois-le-Duc, a man of large attainments in mineralogy and chemistry especially, and at one time a *protégé* of the King of Holland. In the gentleman at the near end of the table, who appears to be recording the remarks of the chairman, you perceive another physician, Dr. Camillus M. Mann, an Irish refugee, who having boldly but unsuccessfully struck, in 1798, for the

liberty of his native land, has fled from its shores to cast his lot with the dwellers in the New World.

In this outline picture, thus hastily sketched, behold the men who, with slender pecuniary means, but with admirable prevision and indomitable will, laid broadly and deeply the foundations of the Academy of Natural Sciences of Philadelphia, on the evening of Saturday, the 25th day of January, 1812. I say broadly and deeply, and I say it advisedly, for, from the scanty memoranda of the early meetings of the Academy which have been preserved, we gather that the founders considered ignorance of the laws of nature to be the prolific parent of many of the evils to which man is subjected, and they, consequently, recognized fully the necessity of improving the condition of mankind by seeking to enlarge the bounds of knowledge, and imparting what they thus acquired to others.

Furthermore, they clearly perceived, as we learn from the early minutes of the society, that the operations of nature demand unprejudiced, attentive, and severe scrutiny: and, in order that they might aid each other by a comparison of observations, they also declared that their discussions must be free.

Freedom of scientific thought and discussion, the cultivation of the natural sciences exclusively, and the diffusion of this kind of knowledge among the people, were the principles which guided Speakman and his associates in their great undertaking. Indeed, the founders of the Academy (under which honorable title must also be included that eminent naturalist, Mr. Thomas Say, who became one of their number a few months after their first meeting) were evidently penetrated with the restless spirit of scientific inquiry which was then so rife in Europe. The fact, moreover, of living, as they did, in that memorable quarter of a century which witnessed the great American and French revolutions, and the famous though short-lived Irish rebellion, could not fail, in the case of such young, enthusiastic, and reflective minds, to impress them strongly with ideas of political freedom and the necessity of establishing this freedom upon the enduring rock of the enlightenment of the people.

Mr. Gilliams was born in the closing year of our revolutionary war, and Mr. Say four years later; while Dr. Troost, the first President of the Academy, was ushered into the world in the very year made memorable by the declaration of American Independ-

ence. He was eighteen years of age, therefore, when the French Revolution terminated with the death of Robespierre. Having received his medical diploma from the University of Leyden, he practised pharmacy for a short time in Amsterdam and at the Hague. Afterwards he travelled extensively in France, Italy, Germany, and Switzerland, and became the pupil and companion of the celebrated Abbé Rene Just Haüy, with whom he studied crystallography. In Paris he became the associate of many of the most eminent scientific men of the day, and was elected in 1810 a correspondent of the Museum of Natural History of France. Two years later we find him in Philadelphia assisting in founding the Academy. Of Dr. Mann we simply know that in 1798 he was old enough to take an active part in the Irish rebellion, and that before coming to this country he also had spent some time in France seeking aid for his compatriots. Mr. William Maclure, who joined the Academy in June, 1812, and who acted as its second president for more than twenty-two years, was born in Scotland in 1763. Endowed with an eminently philanthropic and benevolent mind, and believing that knowledge and intelligence are the true sources of human happiness and prosperity, he used the large wealth of which he was happily possessed, to foster institutions of learning and to disseminate knowledge as much as possible. He travelled much in his own country, in France, Spain, the United States, and Mexico. We are told by his biographers that he "visited these countries while in a state of political revolution, that he might be near to extend assistance to the poor and suffering." Now a moment's reflection will show, I think, that these men, in the course of their studies and travels, could not avoid being impressed by the spirit of free inquiry in science and politics by which they were everywhere surrounded. In view of the facts just presented, and from what we know of the lives and opinions of the originators of the Academy, and of the motives which actuated them in banding together for the cultivation of natural knowledge, it appears to me not inappropriate to regard the Academy as, in reality, an outgrowth of that great intellectual and democratic movement which, during the latter half of the eighteenth century, swept over Europe and a part of America, and was characterized by an extraordinary activity in the study of nature, coupled with a growing demand on the part of the governed classes for larger social and political privileges. So

correct does this idea appear to me that I am led, in this connection, to refer briefly to the condition of science in Europe in the latter part of the eighteenth and the beginning of the present century, when the first feeble and apparently insignificant attempts were made to rear, in Philadelphia, a temple of the natural sciences.

To the student of history it is well known that in France, under the administrations of those famous cardinals—the far-seeing Richelieu and the astute Mazarin—a powerful impulse was given to the highest branches of learning. From the hour that Louis XIV. ascended the throne, however, this impulse began slowly to be arrested by the gradual inauguration of a policy fatal alike to the intellectual and mechanical interests of the country. Mathematics, astronomy, the mechanical and inventive arts, anatomy, physiology, theoretical and practical medicine—all fell more or less rapidly into decay. With the death of Louis in 1715, the intellectual decadence of France was complete. Her great men, one after another, had passed away, until at last she was without literature, science, and arts. With the appearance of a new order of literary and scientific men, in the middle of the eighteenth century, she began at length to emerge from this stagnant condition. In 1735 Newton's "Treatise on Fluxions" was translated into French by Buffon. Three years later Voltaire made the people of France acquainted with the philosophy of Newton in a manner so clear and forcible as to cause it to supersede that of Descartes. He also gave popularity among his countrymen to the writings of Locke, from which, according to Buckle, Condillac drew the materials of his system of metaphysics, and Rousseau his theory of education. In 1749 attention was strongly directed to the study of natural history by the celebrated Buffon, who, in that year, commenced the publication of his famous work on that subject, and in glowing language advocated the unity of the human race, and endeavored to show how climate and other physical conditions influence the geographical distribution of animals. In 1751 a popular account of Bacon and his philosophy was contributed by D'Alembert to the Encyclopedia. In 1754 Condillac, who Cousin declares was the only metaphysician produced by France in the eighteenth century, published his famous treatise on Sensations. Four years afterward appeared the remarkable essay of Helvetius on the Mind. These works undoubtedly gave

a powerful impetus to the study of the natural sciences at the close of the last century. For their authors, with great ability and with much logical acumen and fulness of illustration, maintained most peremptorily, as Locke had done more than a century before, that all our knowledge is really due to the study of the external world. Under the influence of the leading principle thus forcibly inculcated, some of the ablest intellects of France began to devote themselves, with extraordinary activity, to the study of the phenomena of nature. The laws of the radiation and conduction of heat were worked out by Prevost and Fourier; electrical phenomena were investigated by D'Alibard and Coulomb, while Malus and Fresnel, by their researches upon double refraction and the polarization of light, extended the bounds of our knowledge of optics. At the same time Lavoisier, by investigating with great ability the laws of oxidation, placed chemistry upon a strictly scientific basis, and, in conjunction with Berthollet, De Morveau, and Fourcroy, laid down, for the first time, a systematic chemical nomenclature. Meanwhile, geology was also cultivated with eminent success by Buffon, Rouelle, Desmarest, Dolomieu and Montlosier; while astronomy, both physical and mathematical, was materially advanced by La Grange's discovery of the periodical inequalities of the planets, and by the publication of the "Mechanique Celeste" of Laplace, in which was clearly presented to the world for the first time the famous "nebular hypothesis"—an hypothesis which is steadily approaching the character of a demonstration with every new discovery in astronomical science, and which has not only anticipated, but has also paved the way for, the co-ordinate doctrine of evolution in biology. In 1762 Daubenton gave a new interest to palæontology by applying, for the first time, the principles of comparative anatomy to the study of fossil bones. In this epoch, also, the illustrious Cuvier gave to both geology and palæontology an eminently philosophical character by practically associating the study of the earth's strata with the fossil remains found therein. This greatest of all descriptive anatomists did much for philosophical natural history by showing that the classification of animals must be based upon the comprehensive study of their organs rather than their external characters. Histology, botany, and mineralogy likewise found zealous investigators during this remarkable intellectual period. While Bichat with scientific skill and industry was

demonstrating that the study of the organs of an animal must be subservient to the study of the tissues composing them, and while Adanson, Duhamel de Monceau, Desfontaines, and especially Jussieu were bringing to light many of the important facts concerning the structure and physiology of the vegetable kingdom, Romé de Lisle and Haüy were as actively engaged in studying the structure of minerals and applying the principles of geometry to the elucidation of their forms.

Turning, now, to Great Britain, we find that science, though not so actively cultivated, during this period, as in France, was by no means neglected. In 1753 was founded, at the cost of the government, the British Museum, which for many years has been so largely instrumental in promoting natural science in the United Kingdom. Between the years 1759 and 1804, the science of thermotics was greatly advanced by Black and Leslie, who, with much breadth of mind and industry, not only demonstrated the laws of specific and latent heat, but made possible the recognition of those remarkable doctrines, the development of which has stamped the science of the present century with its distinctive character. I allude to the indestructibility of force and the correlation of the forces as modes of motion. At this time, many of the fundamental facts of chemistry were discovered. Carbonic acid gas was isolated and studied in 1757 by Black. The discovery of oxygen was announced in 1774 by Priestley, together with a description of some of its important properties. A year later he made known the fact that the air is composed of oxygen and nitrogen; and in 1776 he made physiology his debtor by proving that the change in color which the blood undergoes in passing through the lungs is due to the absorption of oxygen—an important and fundamental fact in the chemistry of respiration. From 1799 to 1812, chemical science was also promoted by Sir Humphry Davy, whose great achievement—the decomposition of the fixed alkalies by galvanism—constituted a new era in this science. In 1808, just four years before the founding of the Academy, Dalton gave another impetus to chemical philosophy by announcing, as deductions from the atomic theory, the well-known laws of definite combining proportions—laws which have done so much to perfect the analytical and synthetical processes of the chemist. Another remarkable discovery of this period—the composition of water—was made in 1783, by Watt and Cavendish, independently of each other.

In the early years of the present century, optical science received a powerful impulse from the labors of Dr. Thomas Young, who made the important discovery of the interference of light, and gave to double refraction a rational theory by advancing a plausible hypothesis of the propagation of light through an elastic medium in a manner not contradictory to any of the well-known facts and laws of dynamics.

Geology, too, was not without its zealous cultivators. In 1788 Hutton published his celebrated "Theory of the Earth," in which, according to Lyell, may be found the germ of the metamorphic theory. Scientific geology in England owes its existence to William Smith, who, between the years 1790 and 1815, made a laborious examination of different strata in Great Britain, and finally published the first complete geological map that ever appeared. In 1807 was formed the London Geological Society, the members of which early began with untiring industry to collect the facts relative to the structure of the earth's crust. Owing to the assiduous and intelligent labors of John Hunter, comparative anatomy, in the last quarter of the eighteenth century, became, for the first time, in Great Britain, a science of importance. In astronomical science many important facts were discovered and recorded. Maskelyne, in 1790, published an admirable catalogue of the stars, while Sir William Herschel, between 1799 and 1820, may be said to have recreated astronomy and enlarged our views of the immensity of space by his astounding discoveries.

In the mean time, science was steadily though less rapidly unfolding its fair proportions in various parts of Europe. The integral calculus and analytical mechanics were greatly improved between 1727 and 1783 by Euler, the celebrated Swedish geometer. In Germany, astronomy was cultivated from 1779 to 1815 with signal industry and success by the physician Olbers, who, besides discovering several of the asteroids, published an improved method of calculating the orbits of comets. During this period, Werner, in Germany, and Pallas, in Russia, made many important contributions to geological science. By the publication, in 1774, of his short but very remarkable "Treatise on the Characters of Minerals," Werner accomplished for the terminology of mineralogy what the "Philosophia Botanica" of Linnæus had done for that of botany nearly a quarter of a century before. Moreover, his celebrated 'Classification and Description of Mountains," which appeared in

1787, did much to give to geology the rank of a positive science. In the mountain ranges of Siberia, Pallas discovered the general law of the succession of the granitic, schistose, and calcareous rocks—a discovery which has given birth, as Cuvier affirms, to all modern geology. In 1808 Berzelius, by the publication of his admirable "System of Chemistry," greatly enlarged the boundaries of chemical science. His vast analytical labors did much to place the atomic theory upon a sure foundation. In Italy, near the close of the last century, electrical science was measurably promoted by the labors of Galvani and Volta. The former, in 1791, made known his curious researches upon the influence of electricity upon muscular motion; while the latter, about the same time, invented his well-known electric pile, by which he showed that a disturbance of electrical equilibrium was produced by the mere contact of different bodies, and that the electrical current circulated in one constant direction through a circuit composed of different conductors. Between 1753 and 1812, anatomy, physiology, and general natural history were cultivated with much success in Europe by Linnæus, Pallas, Spallanzani, Camper, Blumenbach, Felix d'Azara, and others. In addition to his "System of Nature," "Botanical Philosophy," and other valuable contributions to the literature of botanical science, Linnæus, in 1753, published the "Species Plantarum," in which, for the first time, was adopted the happy idea of distinguishing species by adding a simple descriptive word to the generic term. Camper and Blumenbach, in addition to their other labors, cultivated ethnology with much zeal. Blumenbach, especially, by the publication of his "Decades Craniorum," laid the foundation of the science of human craniography. It was during the great scientific epoch now under review that the illustrious Humboldt entered upon his wonderful career of extensive travel and varied scientific research. In the ten years immediately preceding the founding of the Academy, he had already published valuable works on the physical geography, geology, zoology, comparative anatomy, and ethnology of the northern part of South America and Mexico, together with important memoirs on the astronomical observations and barometric measurements made by him in conjunction with his fellow-traveller, Bonpland, during their five years' exploration of little-known regions of the New World. These works, together with the "Aspects of Nature," which first appeared in 1808, did more, perhaps, than the writings

of any other scientist of that period to call attention to the study of natural phenomena.

Such, briefly, was the scientific outlook in Europe at the close of the first decade of the nineteenth century. What was the condition of science at that time in the New World? Meagre indeed. Franklin, that "mighty genius," as Mirabeau styled him, had been resting in his grave full twenty-two years when our Academy was born, and science in Philadelphia—I may say in America—lay sleeping with him. From the time that he had experimentally identified lightning with the electric fluid no great scientific discovery had been made in the United States. The American Philosophical Society, which he was instrumental in creating, had been in existence forty-three years, and had published in all that time but six volumes of its Transactions. The College of Physicians, founded in 1787, had issued, in 1793, the first and, up to 1812, the only volume of its publications. In addition to these institutions, two medical societies of but little importance, one botanical association known as the Linnæan Society, the Philadelphia, Loganian, and Friends' Libraries, with two small circulating libraries, were the only available aids to the literary and scientific student. Strictly scientific works were scarce, and scientific men but few in number. Between 1739 and 1803, James Logan, Dr. John Clayton, John and William Bartram, and Dr. Benjamin S. Barton had published various more or less valuable works on botany. The celebrated David Rittenhouse, whom Renwick, his biographer, pronounced as "second to Franklin alone in point of scientific merit, and the equal, in point of learning and skill, as an observer, to any practical astronomer then living," had, some years prior to his death, in 1796, contributed many valuable papers on astronomical, philosophical, and mathematical subjects to the early volumes of the Transactions of the American Philosophical Society. In a later volume of these Transactions, Mr. Maclure, who has been called the pioneer of American geology, published an account of a geological survey of the United States made by himself in 1809. In ornithology a new era may justly be said to have been established in 1808 by the publication of the first volume of Alexander Wilson's magnificent work on American birds, the fifth and sixth volumes of which appeared in 1812.

The mass of the people of Philadelphia were then, as they are now, but little interested in purely scientific studies. The few

persons who directed their attention to such inquiries, having neither cabinets nor books in the special departments of natural science at their command, were forced to contend with many difficulties.

Amidst such inauspicious surroundings, and upon the eve of a war with Great Britain, the founders of the Academy began their great work, which, long ago, would have perished in the bud, had it not been for the important principles involved in the attempt. For it often happens in the affairs of men that the importance of the objects to be accomplished gives to the efforts made in their behalf a degree of perseverance which becomes the guarantee of ultimate success.

Did the time permit, I would fain dwell upon the trials and difficulties experienced by the resolute men whose labors we this day commemorate. I might interest you with details of their early meetings held at Mr. Speakman's residence, and of the subsequent sittings which took place at the house known to the citizens of that day as "Mercer's cake shop," where the title, "Academy of Natural Sciences," was first adopted; I might describe to you the little room over the milliner's shop in Second, near Race Street, in which the present magnificent museum and library of the Academy were begun by the donation of books and dried plants, a few stuffed birds, some shells and insects, and a handful of artificial crystals, all presented by the members themselves; I might tell you how, as the museum increased, it was found necessary to move it to the larger accommodations afforded by a house in the neighborhood; how a collection of minerals was purchased for the Academy by Mr. Speakman, who advanced the money from his own private means; how public lectures were delivered on mineralogy by Dr. Troost, on entomology by Mr. Say, and on botany by Drs. Waterhouse and Barnes, to large audiences of ladies and gentlemen; how, in July, 1815, the cabinet and library, now considerably increased, were moved to a building expressly erected for them on a vacant lot in the rear of Mr. Gilliams's residence on Arch Street; how the war with Great Britain which broke out in 1812, and continued during the first three years of the society's existence, interfered very seriously with its progress by interrupting, to a considerable extent, intercourse with Europe, and thus almost entirely preventing the importation of much-needed scientific books; how several of the members were drawn

away from their quiet pursuits to act as volunteers in defence of the city; and how, finally, notwithstanding the zealous efforts that had been made to advance the interests of the Academy and obtain for it the public support it deserved, the list of its members at the end of three years contained but twenty-five names. In 1820 the society numbered one hundred members and one hundred and ninety correspondents, and began, for the first time in its career, to be favorably recognized by the cultivators of natural knowledge in Europe as well as America. The lot and building at the southeast corner of Twelfth and Sansom streets having been purchased with funds supplied by Mr. Maclure and other members, the Academy moved to this locality in May, 1826. Thirteen years afterwards the collections had increased so much as to require still larger space for their accommodation. Accordingly, the present site at the southwest corner of Broad and Sansom Streets was secured, and a large and commodious edifice erected through the munificence mainly of its large-hearted president, the late Mr. William Maclure. The building was enlarged in 1847, at the expense of another benefactor of the Academy, the late Dr. Thomas B. Wilson; and again in 1855, by means of a fund raised by subscription among the members and their friends. In this building the sessions of the Academy have been held for the last thirty-two years, during which time its utility as an educational institution, and as a centre of scientific research, has been steadily increasing.

Thus slowly and laboriously advancing, encountering many obstacles, now succumbing to them and anon overcoming them, constantly embarrassed by the want of funds, deriving no assistance from either the State or municipal government, except exemption from taxation, and obtaining but little aid outside of the immediate circle of its members, the Academy, after the lapse of little more than half a century, has become famous in the great republic of science, has achieved an enviable reputation not only in this country, but in the Old World, as a chief focus of scientific activity in the United States. As such, as the champion of education of a special kind, as the earnest promoter of natural knowledge, it deserves the respect and hearty support of the citizens of Philadelphia.

Listen, I pray you, to what the society has been able by its own

unassisted efforts, to accomplish in the brief period comprised within the limits of a single human life.

It has gathered into its museum more than 400,000 specimens of natural history, many of them unique, and not to be replaced by any expenditure of money, time, or labor. It has created a grand library, containing nearly 23,000 volumes, many of which are not to be found in any other library in the United States. Of some of them duplicates cannot be procured at any price. This library, which is one of reference exclusively, is of incalculable value to men of science in this country. It is constantly consulted not only by persons residing in this city, but also by students from all parts of the United States; not only by its own members, but by many others engaged in scientific research; for the society, true to the principles of its founders, true to their desire to diffuse knowledge as much as possible, has never refused permission to any respectable persons to consult its treasures freely.

The Academy, early recognizing the importance of contributing to the common stock of knowledge any discoveries in natural science made by its members, issued, in May, 1817, the first number of a journal of its transactions. The first series of this journal terminated in 1842, and consisted of 8 octavo volumes, of 2912 pages, containing 237 papers contributed by 56 authors, and illustrated by 161 plates. In 1841 another publication known as the "Proceedings," was commenced. Up to the present time, 22 volumes, each averaging 400 pages, and containing the verbal, and many of the written, communications made at the meetings of the society, have been published. In 1847 a second series of the "Journal" was begun in quarto form. Seven volumes of 2820 pages in the aggregate, and containing 116 articles, contributed by 50 authors, and illustrated by 318 well-executed lithographic plates, have appeared. In 1865 the Academy, through its conchological section, commenced the publication of another serial, the "American Journal of Conchology." Of this, seven volumes have been issued, containing in the aggregate 2500 pages of printed matter, illustrated by 150 plates, many of them colored, besides about 1000 wood engravings. These publications are exchanged with about 200 scientific and philosophical institutions located in the United States and South America, in Europe, Asia, and Liberia. While serving as a medium for the dissemination of a large amount of technical knowledge hitherto unknown or

unrecorded, they have acquired for the Academy and its students, a world-wide reputation, and, by giving to Philadelphia a definite scientific character and position, have enhanced our national respectability abroad. They have shown that our city has its representatives of mind as well as of wealth, that it is alive to the intellectual as well as the material needs of mankind.

The beneficial efforts of the Academy have not been confined to the collection of books and specimens and the publication of learned papers. It has, also, as its archives show, aided, both by judicious counsel and pecuniary means, many scientific expeditions, whether projected under the patronage of government or conducted by private individuals. In this way it has assisted in developing the topography, meteorology, natural history, and ethnology of many parts of this country, of the islands of the South Sea, of the frozen Polar zone, and the burning African land. By means of a sum of money annually donated by the children of the late Augustus E. Jessup, for many years a member of the Academy, it has supported a number of young men while devoting their time and energies to the acquisition of a practical knowledge of the natural sciences.

To bring together the appliances necessary for scientific study, to give to the world the important results of its toilsome, protracted, and self-denying labors, to aid in their researches those who have given evidence that they possess the rare ability and the willingness to become the interpreters of nature, to inculcate a taste among the people generally for the natural sciences by exhibiting its rich collections for many years, without charge—such has been the work of the Academy, such its noble mission.

When we reflect that the institution is supported entirely by donations and the annual contributions of its members, very few of whom possess large means; when we consider that since its formation not more than five hundred citizens of Philadelphia have enrolled themselves in the list of its members; when we recall the fact that it possesses no estate yielding revenue, that for many years it struggled under the burden of a heavy mortgage upon its building, and that, until this debt was extinguished in 1859, by the generous act of Dr. Wilson, its legitimate income was not more than sufficient to defray its current expenses; and when we remember that the classing, labelling, and arranging of the specimens have voluntarily been done by a few of the members,

the most of whom have been able to give to this work and to their studies only the leisure moments snatched from their daily vocations, we may well be astonished at the results it has accomplished —results which compare favorably in many respects with those achieved by similar institutions, which for many years have been sustained by the kingly governments of Europe. By fostering science it has proven itself a benefactor of mankind. For the labors of scientific men, though often but little heeded when first promulgated, or looked upon as curious, and, it may be, as useless speculations, are really not lifeless germs. Like seed fallen by the wayside, though neglected for a while, they nevertheless spring up in due time and blossom and bear fruit; like the tiny brooks which feed the mighty river upon whose bosom the commerce of a great nation is ultimately to be borne, they find, at length, a marvellous expression in the practical affairs of every-day life.

To appreciate properly the efforts of the Academy we should contemplate for a moment what science has done for mankind, especially during the last sixty years.

Look for a moment at savage man, who finds in his material wants, the first incentive to the employment of his powers of observation in the acquisition of natural knowledge. Inferior to many of the lower animals in the keenness of his senses, he has, vastly more than they, felt the pressure of the external world upon him. The necessity of obtaining subsistence, providing shelter against the weather, and means of defence against his enemies, arouses his dormant intellectual energies. He begins to observe how sunshine, rain, and wind affect the growth of the plants around him, especially those supplying him with a portion of his daily food; how the germinating seed is developed into a plant; how the plant blossoms and bears fruit. He learns to distinguish nutritive from poisonous plants, observes the effects of fire and of natural forces, scans the starry heavens with eyes brimful of superstitious wonder, and learns at length to couple the motions of the heavenly bodies with the ever-recurring changes of the seasons. Thus, face to face with the unalterable facts, the inexorable laws of nature, his reason enters feebly upon that career of inquiry which, though its immediate and pressing object is simply the amelioration of his physical condition, is destined, after long ages, to place him in possession of those classified groups of facts and

principles which we denominate mathematics, physics, chemistry, geology, botany, biology, social, political, and moral science.

Science, thus created, has rescued savage man from the bondage of ignorance and gross superstition, and, by giving him command over the primal forces of nature, has elevated him in the economic, social, and moral scale. It has benefited him by improving agriculture, developing and utilizing the staples of commerce, and increasing and cheapening the means of transportation. It has bridged the ocean and made its waves a means of conveyance from one hemisphere to the other, thus bringing distant nations face to face, as it were, and enabling them to exchange their handicrafts quickly and profitably. It has thrown huge bridges—wonders of engineering skill—over impassable rivers, and covered the earth with an endless net-work of railways. The classic fable of Mercury, cast from Olympus, becoming the messenger of the gods, it has practically realized by drawing from heaven the electric fluid and compelling it to act as the letter-carrier of man along thousands of miles of telegraphic wire. Nay, *mirabile dictu*, it has bound together the two hemispheres with mighty submarine cables, along which our scientific Hermes speeds with his letter-bags at the rate of 19,000 miles in a second of time. It has introduced, as motive power, thousands of steam-engines into mills, mines, and factories, with the most extraordinary industrial and financial results. By inventing a multiplicity of apparatus for accomplishing, in a simple and effective manner, a great—I had almost said an endless—variety of purposes, it has increased the facilities of production, simplified and cheapened many manufactures, remodelled the arts, and made labor so easy and rapid that it is now possible to perform an amount of work which no combined manual effort could hope to accomplish. Constantly discovering new raw materials, it is constantly adapting them to the material wants of life. It has taught us to bleach and to dye, to spin and to weave, to decompose and recombine, and in various ways to modify and to call into existence the hidden, useful properties of the numberless substances that nature gives to man for his convenience and comfort. It teaches us how to irrigate and manure barren soils into fruitful fields, how to transform the wild currant into the sweet grape, how to convert its juice into wine, and this into ether; how to transform a caterpillar into a silk-worm, and to weave into velvet the silk which it spins.

Diving into the bowels of the earth, it brings forth coal and iron. From the former it distils, on the one hand, a brilliant light, and, on the other, a magnificent series of dyes rivalling in gorgeousness the colors of Tyre. The latter it converts into steel, and forges this into bars, and even, as if to show its amazing dexterity, hammers it into laminæ rivalling the leaves of a book in thinness and flexibility. It bleaches rags to whiteness, and gives to the calico-printer indigo and ultramarine dyes. From refuse soap-suds it reclaims important fatty matters; from the leaflet of the pine tree it obtains cloth capable of being woven into various articles of dress. It has transformed pulverized bones and the sewage of cities into manure, the refuse of the gas-works into ammonia, ether, and flavoring extracts; and old rags into clothing, paper, and many ornamental articles.

But the acquisition of natural knowledge, while adding directly to the resources of our material civilization, has conferred upon man practical benefits of another character. The proper application of our advanced knowledge of the laws and conditions of life, both in health and disease, has done much not only to mitigate individual suffering and to prolong individual life, but it has also enabled whole communities to protect themselves, more effectually than in former years, from the ravages of epidemic disease.

Though often foot-sore and weary in this long and solemn march called the progress of science, though often bruised and broken in his struggles with a stern and unrelenting nature, man at length rises to the realization of the fact that he cannot live by bread alone. His mental efforts, directed to the improvement of his material condition, have given rise to intellectual wants, to the irrepressible desire to understand the mystery of nature, to know, in the language of Goethe's "Faust:"—

> "To know what the world contains
> In its innermost heart and finer veins,
> To see all its energies and seeds,
> And deal no more in words but in deeds."

Perplexed and amazed in the midst of the knowledge which he has so laboriously wrested from rock and tree, from river and cloud, he obstinately questions the universe about him, interrogates the consciousness within him as to the meaning of creation, the significance and purpose of man in the order of that creation, whence

he comes and whither he goes. To nature he says, in the words of Shelley's "Alastor,"

> "I have loved
> Thee ever and thee only; I have watched
> Thy shadow, and the darkness of thy steps,
> And my heart ever gazes on the depths
> Of thy deep mysteries. I have made my bed
> In charnels and on coffins, where black Death
> Keeps record of the trophies won from thee;
> Hoping to still these obstinate questionings
> Of thee and thine."

But these questionings, these yearnings of the soul, meet with a vague and evasive response. Loving the light and seeking it, the student of nature comes out of the search baffled and sad, but not discouraged. In his attempts to penetrate the outward semblance of the numberless objects that engross his attention, and attain the inner and hidden meaning, he finds himself suddenly confronted with the unknown and the unknowable, discovers imperfections in his knowledge that cannot be remedied, and feels that the aspirations of his soul cannot be realized. Beyond the sensual phenomena of nature, behind this veil of Isis, he beholds forces which dreamily waver before him, and which continually elude his eager grasp. Thus he awakens to a painful consciousness of the limitation of his faculties, and to the recognition of a Power vastly superior to himself—a Power "past finding out." In this consciousness, and in the feelings of helplessness and dependence engendered by it, lies the germ of the religious idea—the essence of natural religion. Thus out of the philosophy of nature is evolved the philosophy of spirit, as the flower is developed from the stem. Though unable to grasp the secret idea of nature, though unable to understand the reason and the object of the eternal and infinite play of matter and force around him, he, nevertheless, constantly rises in his pursuit of natural knowledge to grander and still grander conceptions of the universe, to more and more philosophical views of himself as part of that universe. He rises to the recognition of fixed order and immutable law in the moral as well as in the intellectual and physical worlds. He fashions for himself a new morality, based upon a more exact acquaintance with the laws of his organization and his relations to the animate and inanimate nature about him.

Through the earnest and untiring efforts of its members, aided by the wise munificence of many generous patrons of science in this city, the Academy is to-day enabled to lay the corner-stone of a larger edifice, and thus to inaugurate a new and still brighter era in its existence. Assisted by the liberal and continued support of the citizens of Philadelphia, it is destined, in its efforts to promote and popularize knowledge, to become more than ever the pioneer of advanced science, more than ever a great school for the higher culture of the mind, more than ever the exponent of that intellectual revolution which is, at the present time, slowly but surely changing the aspect of society.

Professor H. C. Wood, Jr., M.D., of the University of Pennsylvania, was introdueed, and delivered the following address:—

Ladies and Gentlemen: Standing here to-day on this platform in presence of some of my masters in science, there comes upon me a flood of reminiscences from the past, and in the uncertain twilight of the future I seem to see a vision fair and fruitful, though misty and uncertain in its outline.

The tiny doors which close the cells where memories sleep are flung wide open, and scenes of the long-ago come upon me as sharp and clear as though in the light of the present. It seems but yesterday, when, a lad of some ten summers, leading my little brother by the hand, with eager, anxious heart, I rang the front-door bell of a house in Arch Street, near Fourth, and asked for one of those who now sit upon this platform. Well do I remember the disappointment of the final answer to my entreaties that I was too young to be given tickets to the Academy of Natural Sciences. Childish griefs and childish joys, though they seem to us trifles light as air, are yet real as life, and the impression of the choking disappointment of that hour time will not efface.

Again I see myself, now in advancing youth, armed with a letter of introduction, ascending the steps of a modest dwelling in Sansom Street, wondering, as I ring, how strange it is that so great a man should live in so small a house. Little then did I know the truth of the saying of the prose poet, Ruskin, "That the world pays least for its best work."

The word of the master of the little house had, however, power enough to unlock that chamber of mysteries of my childish fancy,

the Library of the Academy, and, astonished, in my joy, I roamed at will and fastened as I wished on the books that crowned the walls. But another step was wanted. I could not handle the rare treasures locked in the museum cases. I could but flatten my nose against the panes in my efforts to see the specimens. One auspicious morn, however, the keys were given me, and now at last I could touch and handle and taste to my heart's content. It seemed as though the veritable keys of knowledge had been put in my possession, and I had but to walk in and pluck the golden fruits of the orchard.

There comes to me to-day also a vision of the future. I see no longer the homely face of the old Academy, beautified by the thoughts of its usefulness and by the glamour of old association. A new building rises before me, higher and wider in its scope, grander and nobler in its architecture, than the old building that we love, but yet cold and barren in its very newness.

It is to realize this vision that we are here to-day. It is to witness the first beginning of the new life of our loved institution that we are assembled. The trustees, in their faith rather than in their knowledge, in their weakness rather than in their strength, have gone forward, and it rests with the citizens of Philadelphia to decide what measure of success shall crown their efforts.

I know that there are some who see but little value in the study of natural science; who in their folly cry out *Cui bono?* With such to-day I will not pause to reason; if the noonday blaze of this the nineteenth century cannot penetrate the thickness of their intellectual darkness and prejudice, what could the rushlight of my best efforts do? I can only say with reverent feeling, God pity the man and God help the nation that, blinded by its avarice for present material gain, can see no place for the quiet student of God's work.

See yon orchard, with its golden fruit of plenty. Could it be foreseen, or did the little rootlet know, that, working so silently and yet so faithfully in the darkness under ground, it was preparing for such a bounteous harvest? So it is with the scholar in his quiet room; in his most abstruse and apparently most profitless study, he is gathering the knowledge, the power, that perhaps other men shall ripen into the richest material fruit.

There has been made recently, in this city, and indeed there is still being made, an effort to put the University of Pennsylvania

on a wider footing. Far be it from us to-day to dampen the ardor or throw aught in the way of those who are carrying out this work; but none the less is it true that there is a culture deeper, higher, and more profound than any university can give.

This is the self-culture of the true scholar, for which a university at best can but lay the foundation. The highest culture must be forever self-culture. A man may be aided by others up to a certain point; into the unknown he must travel alone. Aye, more than this, before he reaches that unknown he must for himself trace out the obscure, unfrequented paths which mark the outlying regions of uncertainty in knowledge.

It is to afford opportunity for this self-culture that the Academy exists. There are but few men whom destiny has marked for such a course. The study halls of the Academy must always be for the few—but the work of the few is the life of the nation. I must assert, then, the pre-eminent claims for such institutions as our Academy. Talk of your universities—of the large crowds that haunt their doors—of the annual overflow of vigorous trained young talent wherewith they bless surrounding regions. Why, our old Academy is the gymnasium in which men train themselves for professorships in the universities.

There is a class of medical men who, in their early professional life, study deeply the natural sciences, and who often through life add to the practical duties of their profession investigations of natural history. I do not remember a single great name of such a character in Continental Europe. Yet in the British Islands, the brightest lights of the profession—the Hunters, Coopers, Brodies, Reids, Bells, Bealcs, Pagets, etc.—the foremost medical thinkers, leaders, and practitioners of their days, have been of this character—students of natural history who have applied the methods and facts of their sister science to their profession, and thereby climbed to their proud pre-eminence. In our own city the names of Rush, Morton, Harlan, Wood, and some about us, mark our origin. And, indeed, it is chiefly through such men that the great renown of our city, as a medical centre, was acquired. Speaking for this class of men, I would say to the citizens of Philadelphia, as they value the fair name of their city; as they respect and honor that profession into whose keeping they place all that is dearest to them; as they hope for skilful rescue

when life is in peril, to see to it that men of this character are not deprived of their opportunities for culture and growth.

For myself, I wish to say to-day, that whatever of value I may have achieved in the past, or whatever of value, little or great, I may achieve in the future, as a medical investigator, is largely due to the lessons of close observation, of patient comparison, of cautious deductions, learnt in the close aisles and dusty by-rooms of the old Academy—the only institution which I ever have or ever will claim as my *Alma Mater*—the veritable mother of my intellectual life.

A few weeks before the lamented Professor Frazer's death, a prominent business man of this city told me that he called on him in reference to a grandson who rebelled against learning Greek or Latin. Mr. —— asked the Professor, "Is there any use in his learning these things?" "Where is he to live?" was the reply. "In Philadelphia." "Ah, in Philadelphia! Why, then it makes little difference whether he is an ignoramus or not."

There was deep truth in the Professor's sarcasm. It has seemed in the past as though our city was willing to settle down to be the far-famed paradise of mediocrity—a dead level, unbroken alike by abysses of gross ignorance or masses of high culture.

There has, however, come into this old city of ours, I am most happy to believe, a new life. Arousing herself from her lethargy of years, like a giant refreshed by sleep, she is marching forward in all her interests; stretching out the arms of her commerce to grasp at once the Occident and the Orient, pouring forth from multitudinous workshops products of a continent, sending her sons to drag out the untold treasures of the neighboring mountains, she is multiplying her wealth with almost magical rapidity. Her educational interests, awakened by the hum of universal labor, are forgetting their feeble steps in this the day of their rejuvenation, and it's well that our cherished institution now steps forward to the changing music of the times.

Not long since there came to a neighboring city a man of years and said to its citizens: I have nothing to give but my time and my reputation, but if you will find me the means I will found a museum that shall far eclipse the famous Academy of Natural Sciences of Philadelphia; and the citizens of that city, scarcely a third the size of ours, gave him $362,000, and the legislature of a State scarcely as large as a corner of Pennsylvania gave him

$190,000, and the museum is arising in grand proportions, and the fame of it is filling the whole earth. To-day we come before the citizens of Philadelphia not with empty hands. With a library, with a collection that it would take half a million of dollars to gather up; with funds sufficient for future support, this institution only asks a habitation—a house in which it may display its riches.

Trustees of the Building Fund of the Academy of Natural Sciences, we labor, it is true, under that strange curse which seems rooted in the very groundwork of human nature. We are no citizens of a foreign land. We are but prophets without honor in our own country. And yet I say, go forward.

Only with faith and vigor let us work, and it must be that success will crown our enterprise; that ere long we shall raise our jubilant voices under roofed arch tree, in spacious halls and lighted galleries—voices jubilant for labor past, for good works done, for hopes extinguished in fruition.

Dr. Ruschenberger then laid the corner-stone, depositing in it copies of the daily papers of the city, papers relating to the history of the Academy, the by-laws of the Academy, and the number of the Proceedings of the Academy of Natural Sciences of Philadelphia last published.

Rev. Dr. Boardman delivered a prayer, after which the assemblage dispersed.